Quarterly Progress Report

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Near-Term Objectives

1) Analyze data from field work in Southern Ocean
2) Analyze data from bio-optical mooring deployment at Hawaii Ocean Time Series station
3) Conduct joint laboratory experiments at Brookhaven National Laboratory
4) Continue development of information management system
5) Assess effects of ghosting on fluorescence line height algorithm
6) Provide comments on sensor design for Japanese GLI

Task Progress

1) Southern Ocean Data

Ricardo Letelier (a postdoctoral researcher supported by MODIS) is completing analysis of the deployment of two bio-optical drifters in the Southern Ocean. The first publication has been accepted by the *Antarctic Journal of the U.S.* A more complete manuscript will be submitted to an oceanographic journal (probably the *Journal of Geophysical Research*) by the end of the year. The analysis is focusing on the cyclonic eddy in the center of Drake Passage which trapped one of the drifters for forty days. This provides a unique opportunity to study physical and biological processes in a relatively ÒclosedÓ system and to assess their impacts on phytoplankton fluorescence. In particular, fluorescence per unit chlorophyll increased as the drifter left the eddy, suggesting that nutrient stress increased compared with waters inside the cyclonic eddy that were influenced by eddy-driven upwelling of nutrients.

2) Bio-optical Mooring

We deployed our bio-optical mooring (paid for primarily by EOS interdisciplinary funds) at the Hawaii Ocean Time-series station off Hawaii in May. The mooring consisted of a Satlantic spectroradiometer, a small current meter, and data logger. Initial analysis of the bio-optical data showed that the chlorophyll estimates were within the expected range for this location. However, there were indications of a weak temperature dependence in the performance of the spectroradiometer. We are pursuing this with the manufacturer. Analysis will focus on the fluorescence observations.

3) Laboratory Experiments

Ricardo Letelier conducted joint experiments with Dr. Paul Falkowski (Brookhaven National Laboratory) in July on fluorescence and quantum yield. Our analysis of the drifter data had suggested that evaluating fluorescence yield as a function of downwelling irradiance might provide an estimate of the light saturation level for phytoplankton. If this parameter can be estimated from satellites, then our ability to estimate primary productivity will be greatly increased. Experiments with several phytoplankton cultures confirmed this hypothesis and showed that the strength of the correlation depended on the ability of the phytoplankton to develop photoprotective pigments. These results are perhaps the most exciting development of this project. Present models of productivity based on fluorescence are designed for light-limited phytoplankton. Since MODIS will be observing communities near the ocean surface at light saturation, this promising result could be a breakthrough for satellite-based estimates of productivity. Letelier presented these results at the Tenth International Symposium on Photosynthesis in Montpelier, France, in August.

We are still awaiting the arrival of our Fast Repetition Rate Fluorometer. The manufacturer has transferred all orders to another company (Chelsea Instruments) which has far more experience with oceanographic equipment. However, this has delayed our laboratory studies as the FRR fluorometer is a key element of this study of the relationship between fluorescence yield and quantum efficiency.

4) Information Management

We have upgraded our data base management system to SQL Server 6.0 which supports Object Linking and Embedding (OLE). This provides connectivity between our data base and our desktop analysis applications. We are presently reloading our data base of bio-optical data from the California Current as well as our archive of satellite imagery into the data base. The bio-optical data from the Southern Ocean and the HOT mooring will also be included. This system will form the foundation for our quality assurance activities.

We acquired a 100 Gbyte disk array to attach to our Silicon Graphics Power Challenge XL in anticipation of a substantial increase in satellite data sets in 1996.

5) MODIS Sensor Performance

In response to a request from Wayne Esaias, we conducted an analysis of the impacts of ÒghostingÓ on our fluorescence line height algorithms. This test included the use of LOWTRAN to account for atmospheric effects. As expected there were some noticeable effects on the FLH algorithm.

6) GLI Design

Japanese investigators requested comments on the band placement for the GLI sensor scheduled to be launched in 1999. Using their instrument specifications, we showed that a small change in the center wavelength of the fluorescence channel (shifting from 678 to 680 nm) increased the sensitivity of the FLH to changes in chlorophyll anywhere from 10-20%. This information was submitted to our Japanese colleagues and to NASDA.

Anticipated Activities

1) Bio-Optical Mooring and Drifters

We will complete and submit two manuscripts on these field experiments.

2) Laboratory Work

We will complete analysis of these data and begin a manuscript on the results.

3) Information Management

We will continue to develop additional clients for our SQL Server data base. We are using both OLE and Java (from Sun Microsystems) to provide connectivity into our data base as well as links to analysis tools. This work is partially supported by Hughes as part of their prototyping activities.

4) Software

We will continue to integrate our FLH algorithms with the Oceans activities being coordinated by Bob Evans.

Problems/Corrective Actions

As reported in our Semi-Annual Report, we are still pursuing purchase of a Fast Repetition Rate Fluorometer for additional laboratory experiments. The original vendor has ceased operations, but the licenses have been transferred to Chelsea Instruments.